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Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, DC 20554

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Federal Communications Commission  
Office of the Secretary

In the Matter of )

Advanced Television Systems and )  
Their Impact on the Existing )  
Television Broadcast Service )

MM Docket No. 87-268

COMMENTS OF GENERAL INSTRUMENT CORPORATION

General Instrument Corporation ("GIC"), on behalf of its Jerrold and VideoCipher Divisions, submits these comments in response to the Notice of Inquiry ("NOI") in the above-captioned proceeding, 2 FCC Recd 5125.

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### Summary of Position

A Commission decision on a terrestrial broadcast HDTV signal format must take into account the needs of about 50 million cable TV and satellite television subscribers as well. Given these substantial numbers, it would be poor public policy for the Commission to ignore these other segments of the video distribution industry when it adopts terrestrial broadcast HDTV policies.

Compatibility is an important goal; home viewers with NTSC TV receivers should be able to tune to channels carrying HDTV signals and receive NTSC portions of these channels on their existing TV sets. Similarly, the Commission should not select an HDTV format that makes obsolete the existing investment in home earth station equipment and cable television equipment.

HDTV formats that use low time compression factors or none at all are likely to out-perform those that use higher compression factors.

Baseband interface specifications may be needed for monitor/receivers. If different HDTV formats are employed for different transmission and storage media, this will eliminate the costly need to transcode from one format to another.

Even though they are under-represented on the FCC Industry Advisory Committee, we trust that the cable TV and satellite TV industry sectors will be allowed to participate fully in the work of the subcommittees, since this is where the key technical decisions will be made.

GIC Supports the Commission's Efforts to Establish a Standard for Improved Television

The Commission has begun an important proceeding. The results will influence the video and electronics industries for at least the next quarter century. The video delivery industry has changed considerably since the NTSC television standards were adopted. Likewise, technology has evolved, and consumer demand has become more sophisticated. It is now timely to begin the process of establishing a standard for the next generation of video delivery technology.

The issues are complex. Programming, consumer electronics, transmission and distribution methods, and spectrum allocation policy will all be affected. Most of the possible advanced television systems are still in the laboratory or computer simulation phase, still evolving as their designers learn more

about how they perform. It is unrealistic to expect that a standard format can be adopted by the Commission within the next two years. Three to five years is a more realistic timeframe.

At this stage in the process, the Commission should decide which criteria are important in reaching a final decision on an advanced television standard. The Notice of Inquiry is a reasonable vehicle for starting the evaluation of criteria. Our comments are directed toward the policy and technical criteria that we think are important in reaching a final decision on a standard. While the Notice of Inquiry is heavily oriented toward terrestrial broadcasting and the related spectrum allocation issues, we do not feel constrained. We trust that the Commission will give full weight to our comments and those of other parties who have taken a broad view of these complex issues.

The Commission's statutory goal is to improve communications for "all the people of the United States", including cable TV subscribers, satellite TV subscribers, and terrestrial TV viewers. We applaud the Commission for beginning this inquiry. Not only does it serve to focus attention on the important issues relating to advanced television, but through the advisory committee structure, it will result in the Commission adopting new technical standards for an advanced television

format. It is an important step in serving "all the people of the United States."

CATV and Satellite Delivery of HDTV Must Influence Signal Format Decisions

A Commission decision on a terrestrial broadcast HDTV signal format must take into account cable TV and satellite television as well. The NOI virtually ignores these two segments of the video distribution industry, yet about half of all homes subscribe to cable TV and about two million homes have satellite TV receivers. The vast majority of these have no terrestrial TV antenna connected to their TV set, and do not receive TV broadcasts over the air.

Unquestionably, a Commission decision on a broadcast HDTV signal format will have an impact on cable TV and satellite TV. The impact will be felt in two ways. First, broadcast TV signals are often distributed to affiliates in scrambled form and then re-transmitted on both cable TV and satellite TV. Consequently, the Commission must investigate whether proposed signal formats are compatible with the specific propagation and other media-dependent characteristics of cable TV and satellite TV.

Second, a terrestrial broadcast TV format decision will heavily influence TV receiver design. The next generation of TV monitor/receivers must be usable on cable TV and satellite TV as well as terrestrial TV. The Commission must assure that TV set designers take into account the special needs of cable TV and satellite TV when they design the next generation of TV monitor/receivers for HDTV.

It is in the public interest to minimize the amount and complexity of consumer electronics hardware needed to view HDTV on a variety of media. It would be poor public policy for the Commission to ignore these other segments of the video distribution industry when it adopts terrestrial broadcast HDTV policies.

#### HDTV Formats Should Be Equipment-Compatible with Existing Consumer TV Equipment

There are over 130 million NTSC TV sets now in use in this country. The HDTV format that the Commission adopts should be compatible with NTSC to as great a degree as possible. Home viewers with NTSC TV receivers should be able to tune to channels

carrying HDTV signals and receive the NTSC portions of these channels on their existing TV sets.

Nearly 2 million backyard dish owners have satellite receivers that are based on the FM satellite format. These consumers would be adversely affected if the Commission were to adopt an HDTV standard that is incompatible with current satellite TV formats. The B-NTSC format is an advanced television NTSC format carrying compact disk quality stereo audio in the horizontal blanking interval. VideoCipher<sup>(R)</sup> II is a B-NTSC format which has been adopted by the marketplace as a standard for satellite TV. The Commission has recognized that the VideoCipher<sup>(R)</sup> II system is the de facto standard for satellite TV scrambling. The Commission should take into account the needs of the satellite TV segment of the consumer marketplace in its deliberations.

The Commission should not select an HDTV format that makes obsolete the existing investment in home earth station equipment. An example of such a decision might be the adoption of the MUSE format. The MUSE format would have a dramatic adverse impact on home dish owners because it requires a substantial increase in receive terminal sensitivity. If the MUSE format were used for C-band satellite television, an additional 6 dB in carrier-to-

noise (C/N) ratio would be needed to produce video noise performance comparable to that now available. Dish sizes would have to be doubled! The additional cost to the public would be substantial.

Similarly, cable TV systems typically carry video signals with system C/N around 45 dB. HDTV formats that require substantially higher C/N may require expensive rebuilds of cable systems. The advisory committees should take into account cable TV carrier-to-noise ratios in their deliberations.

Another factor that must be considered is the use of the horizontal blanking interval. Both satellite TV and cable TV transmit information in the horizontal blanking interval. Any HDTV format that substantially decreased the capacity of the horizontal blanking interval might be incompatible with these delivery systems.

Any HDTV format the Commission adopts for terrestrial broadcasting is likely to be implemented for pay TV as well. Scrambling, authorization control, addressing and billing will be needed. GIC systems in use today already offer these features. GIC believes that an evolutionary approach to HDTV, which makes use of these features but adds higher video definition and wider aspect ratio, will serve the public interest.



The technical work of the advisory committees must take into account the economic as well as technical needs of the public. The Commission should not be overly influenced by technical considerations to the exclusion of economic considerations. An HDTV format that is the best technically does not necessarily best serve the public interest. We urge the Commission to give substantial weight to the economic interests of the public, as well as the technical interests.

#### Additional Spectrum May Be Required for HDTV Broadcasting

The Commission should retain UHF spectrum allocation flexibility to accommodate TV signals wider than 6 MHz, if that turns out to be needed. NTSC compatibility is important, but it is not clear that an HDTV signal can fit into a 6 MHz TV channel and retain compatibility with NTSC. While several NTSC-compatible systems have been proposed, none have been demonstrated in an actual broadcast or CATV environment. Moreover, there has been little or no study of the quality of pictures transmitted with these formats and viewed on current NTSC TV sets, nor whether satellite delivery of these formats is feasible.

GIC has been and will continue studying methods to implement single channel NTSC-compatible television with improved definition. Our goal is cost effective delivery of TV signals by terrestrial broadcasting, cable TV and satellite TV. It is possible that the use of an augmentation channel for wide aspect ratio and improved resolution may be necessary from a compatibility and consumer equipment cost viewpoint. Consequently, it is important that the Commission preserve the spectrum allocation flexibility for terrestrial broadcasting that may be needed to implement an augmentation channel approach.

#### Use of Time Compression in HDTV Needs Detailed Study

Many of the proposed HDTV systems achieve their higher definition levels and wider aspect ratios by using time compression at the encoder and time expansion at the receiver. The two technical penalties of this compression are the loss in detected video signal-to-noise ratio (due to increase in effective transmission bandwidth) and the impact of multipath reflections.

Multipath reflections, or echoes, in video signals produce "ghosts" in today's NTSC television signals.<sup>1</sup> The time delay between the direct signal and the reflected signal has an impact on the perceived impairment of the picture. If the reflected signal arrives very shortly after the direct signal, the ghost appears so close to the main signal that it simply causes a blurring of the picture rather than a distinct ghost. For echo delays of greater duration, the ghost can be distinguished separately on the screen. Of course, the effective video bandwidth and the signal strength of the multipath signal also have an impact on the perceived impairment; the wider the video bandwidth and the stronger the reflected signal, the more likely it is to cause an objectionable impairment.

With time-compressed video, multipath reflections give rise to two concerns. First, the time compression in the transmitted signal requires an expansion in the receiver; this expansion results in a longer effective time delay. The ghost appears on the display farther away from the main image, and is therefore more objectionable.

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<sup>1</sup>Multipath occurs on cable TV as well as over-the-air TV broadcasting.

Second, in TV systems that time-compress the luminance and chrominance (or whatever components are being transmitted) with different compression ratios, the result is two separate ghosts. Both the delayed luminance signal and the delayed chrominance signal will appear as ghosts. In contrast, with NTSC signals, the entire signal is reflected and a reflection appears as a single ghost.

We must stress that these are preliminary conclusions based on theoretical analyses of the signal formats. The impact of multipath must be measured experimentally before the Commission could use these conclusions as a basis for any policy decisions. Nevertheless, we believe that the impact of multipath must be an important criterion at this stage in advanced television policy development. We urge the Commission and the industry to consider the likelihood that TV formats that use low time compression factors or none at all are likely to out-perform those that use higher compression factors.

#### Baseband Interface Specifications are Needed

We expect that the first use of HDTV will be with program material supplied on videotape or laser disk. These media may

well be using HDTV formats that are different from HDTV transmission formats. HDTV formats may even vary from one transmission medium to another. Consequently, HDTV monitor/decoders are needed for display, having baseband input capabilities. Baseband interface specifications are needed for component video signals so that cable TV converter/decoders and satellite TV receiver/decoders can also supply signals to these monitor/decoders. This will eliminate the costly need to transcode HDTV signals from one HDTV format to another. Moreover, this will minimize the degradation caused by modulating the signal to RF and then passing it through the TV tuner. To avoid this additional cost and degradation, HDTV monitor/receivers should incorporate baseband inputs for video and audio that are appropriate to the HDTV transmission format that are employed.

#### Advisory Committee Study Is Necessary and Appropriate

There are numerous technical questions that need to be investigated before the Commission can reach any decisions on HDTV formats. The advisory committee structure is better suited to deal with such matters than is a notice-and-comment rulemaking proceeding.

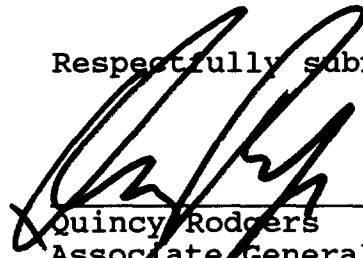
However, we are concerned about the very limited representation on its "Blue Ribbon" committee that the Commission has allotted to the cable TV and satellite TV sectors. We trust that the technical work of the advisory committee structure will be accomplished in the subcommittees and working groups. Participation and voting in these must be open to the cable TV and satellite TV sectors of the industry. GIC gives notice that it intends to participate actively in these important deliberations.

### Conclusions

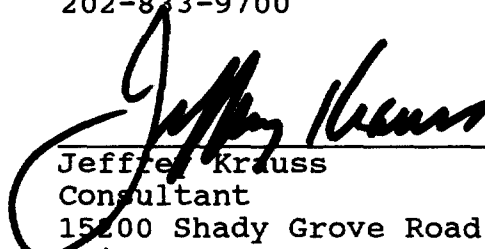
The Commission must consider the needs of cable TV and satellite TV when it adopts a standard format for HDTV. The subcommittees of the Advisory Committee must include representatives from these industry segments. We have described a number of technical and other criteria that must be considered in this process. Compatibility with NTSC receivers is probably the most important of these criteria. Because of the long-lasting impact that HDTV will have on the video delivery industry, the Commission must give full and detailed consideration to all relevant criteria, and must not rush to

judgment without taking into account the needs of all the people  
of the United States.

Respectfully submitted,



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